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Preface

The National Coal Council is a private, nonprofit advisory body, chartered under the Federal Advisory Committee Act.

The mission of the Council is purely advisory: to provide guidance and recommendations as requested by the United States Secretary of Energy on general policy matters relating to coal. The Council is forbidden by law from engaging in lobbying or other such activities. The National Coal Council receives no funds or financial assistance from the Federal government. It relies solely on the voluntary contributions of members to support its activities.

Members of the National Coal Council are appointed by the Secretary of Energy for their knowledge, expertise, and stature in their respective fields of endeavor. They reflect a wide geographic area of the United States (representing more than 30 states) and a broad spectrum of diverse interests from business, industry, and other groups, such as:

- o large and small coal producers;
- o coal users such as electric utilities and industrial users;
- o rail, waterways, and trucking industries as well as port authorities;
- o academia;
- o research organizations;
- o industrial equipment manufacturers;
- o state government, including governors, lieutenant governors, legislators, and public utility commissioners;
- o consumer groups, including special women's organizations;
- o consultants from scientific, technical, general business, and financial specialty areas;
- o attorneys;
- o state and regional special interest groups; and
- o Native American tribes.

The National Coal Council provides advice to the Secretary of Energy in the form of reports on subjects requested by the Secretary and at no cost to the Federal Government.

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Executive Summary

Purpose

By letter dated November 13, 2000, then-Secretary of Energy Bill Richardson requested that the National Coal Council conduct a study on measures which the government or the government in partnership with industry could undertake to improve the availability of electricity from coal-fired power plants. His letter requested that the Council address improving coal-fired generation availability in two specific areas:

- o improving technologies at coal-fired electric generating plants to produce more electricity; and
- o reducing regulatory barriers to using these technologies.

The Council accepted the Secretary's request and formed a study group of experts to conduct the work and draft a report. The list of participants of this study group can be found in Appendix D of the report.

Findings

The study group found the following.

- o Nationally, approximately 40,000 megawatts of increased electrical production capability is possible now from existing coal-fired power plants.
- o Such increased electricity supply can be available through the installation of standard improvements and clean coal technologies. This will have the important effect of increasing efficiency and decreasing emissions per megawatt from such modified plants, thereby improving air quality.
- o Such plant efficiency and increased electricity production capability may only be realized if a return to historic regulatory policy is made.
- o Coal-based electricity will be important for many years into the future. Therefore, regulations and policies employed should encourage the clean use of this resource through accelerated installation of more efficient, cleaner technologies.

The study was divided into two major sections: technology and regulatory reform. The focus of the technology section is on achieving more electricity from existing and new coal-fired power plants using technologies that improve efficiency, availability, and environmental performance. The discussion is divided into three subsections:

- a) achieving higher availability/reliability in the existing fleet of coal-fired plants;
- b) Increasing generation output of existing coal-fired plants; and
- c) Determining opportunities for repowering existing facilities with clean coal technologies as well as building new advanced clean coal technology generation facilities.

Analysis of the U.S. utility industry infrastructure of coal plants reveals a significant potential for increasing generation capacity by taking well-tested measures to improve the reliability/availability of older facilities. This effort, which will come mainly from improvements on the steam generators of these older plants, can create 10,000 MW of new capacity.

Techniques to recover lost capacity and increase capacity above nameplate have been collected from a combination of research studies by utility industry organizations such as EPRI and actual case studies which are detailed in the report. The nameplate capacity of coal units older than 20 years is approximately 220,000 MW; however, due to derating, the existing capacity is only about 200,000 MW.

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This group of plants has the potential for both capacity restoration (about 20,000 MW) and/or improvement (about 20,000 MW). It is estimated that this increased capacity of 40,000 MW could be recovered within 36 months. This can allow the economy to grow while new generation facilities are sited, constructed, and brought into service.

For new coal-fired power generating capacity, Pulverized Coal Combustion in supercritical steam plants (a mature technology) is available with minimal emissions, high efficiency, and at very favorable total production cost.

Repowering of an old existing coal fired power plant with a single modern steam generating unit, equipped with commercially proven emissions controls results in significant reductions in the total amounts of emissions even while substantially increasing the total MWh output of the facility.

Integrated Gasification Combined Cycle (IGCC) has become a commercially available technology for both greenfield and repowering applications. IGCC is a clean, new technology option insensitive to fuel quality variation.

While natural gas will fuel the majority of new capacity additions during this time period there are currently about 321,000 MW of coal-fired capacity in service. While not all of this capacity can be targeted for the new technologies discussed in this report, it is estimated that 75% of it can be retrofitted with one of these technologies. This additional increase in capacity is estimated to be 40,000 MW and much of it could be brought on line in the next three years. This minimizes economic impacts while new generation facilities are sited, constructed, and brought into service without increasing emissions at existing facilities and, in some cases, lowering emissions. Approximately 25% of existing facilities can be targeted for repowering with much cleaner and more efficient coal-based power generation.

However, unless there is a significant change in regulatory interpretation and enforcement regarding the installation of new technologies at existing power plants, it is not likely that any of this additional low-cost, low emission electricity will be produced. The recent change in enforcement procedures by EPA (reinterpreting as violations of the Clean Air Act what had heretofore been considered routine maintenance at power plants) has had a direct and chilling effect on all maintenance and efficiency improvements and clean coal technology installations at existing power plants. EPA has brought legal action against 11 companies and 49 generation facilities since 1998 under the New Source Review section of the 1990 Clean Air Act. The companies involved believe that they were conducting routine maintenance needed to keep these plants in good condition. The result has been that no new efficiency, availability, or environmental improvement has occurred since 1998 when EPA changed its enforcement policy. A return to the historic interpretation of this one regulation alone would allow plant operators the opportunity to install technologies discussed in the report. If just a three percent increase in capacity could be achieved through reducing outages and increasing plant efficiency, it could result in over 11,500 MW of coal-based capacity being added to the current fleet while continuing the downward trend in emissions.

Several other existing regulations seem to be in conflict with the country's attempt to maximize the use of domestic energy sources. Environmental regulation should be harmonized with the energy and national security goals of the country.

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Recommendations

The National Coal Council strongly recommends that the country, with the Department of Energy in the lead, develop a clear, comprehensive energy policy that supports the maximum use of domestic fuel sources, continues to protect the environment by implementing strong but balanced environmental regulations, and harmonizes conflicting regulations affecting energy development and use. Government and industry should work in partnership to achieve the desired goals and remove those regulatory barriers that create obstacles to achieving those goals while preserving environmental performance.

Specifically, the Council recommends that the Department of Energy take the following actions.

- Initiate and lead a dialogue with EPA, with the goal of returning to the traditional pre-1998 interpretation of the New Source Review section of the 1990 Clean Air Act.
- Promote accelerated installation of clean and efficient technologies at new and existing coal-fired power plants.
- Initiate and lead a dialogue with EPA to promote coordinated regulations for ozone attainment into a single compliance strategy.
- Initiate and lead a dialogue with EPA and electricity generators to establish credible and uniform emissions targets, which will provide regulatory certainty for a sufficient period in the future to assure electricity generators that they can achieve a return on investments for performance and environmental improvements.
- Lead the country's effort to develop a clear, comprehensive, and secure energy policy that maximizes the use of domestic fuels, including coal, while continuing the downward trend in emissions.

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**Achieving Higher Availability/Reliability From
Existing Coal-Fired Power Plants**

This section will focus on recommendations that will improve existing coal-fired power plants' reliability and availability to eliminate or reduce forced outages and extend the time between planned maintenance outages. This suggested availability improvement program is meant to restore the plants' infrastructure to a level that restores the original reliability of the plants. Implementation of these recommendations will allow the plants to increase generation output above recent historical output without increasing gross generating capability.

We will show from the use of industry sources on reliability (GADS/NERC) and generation capacity (EIA) that there is a significant opportunity for the utility industry to increase the generation output from our existing fleet of coal-fired power plants by restoring portions of the plant infrastructure to their original condition.

Analysis of the U.S. utility industry's coal-fired plant infrastructure reveals a significant opportunity for increasing electricity output from these plants by taking measures to improve the reliability/availability of the older facilities. Maintaining or restoring plants that are over 20 years old to a condition similar to plants that are under 20 years old can result in more reliable facilities that will be available to play an important role in supporting the increasing strain on our electrical system's reserve margins and electrical demand growth.

Specifically, our analysis has shown that this reliability improvement effort can create 10,000 MWs of equivalent generation capacity within our existing coal-fired fleet of plants. Of particular note is that over 90% of these MWs of capacity will come from component replacement and material upgrades of the boiler/steam generator at our facilities that are more than 20 years old. The U.S. EPA has focused on boiler/steam generator component replacement projects in its recent enforcement actions, applying New Source Review ("NSR") standards to repairs formerly considered routine maintenance, repair, or replacement. The potential regulatory consequences of the EPA's enforcement actions may prevent the utility industry from taking full advantage of this relatively inexpensive way to increase the availability of our national electric generating capacity, which could be implemented in a two to three year time frame.

The U.S. electric generating system's reserve margins have declined dramatically over the last 20 years. This situation has put pressure on the operators of our existing coal-fired fleet to restore, maintain, or improve the reliability and availability of their facilities to keep pace with the growing demand for electricity in the face of limited new capacity coming on line. The mandate for higher availability, lower forced outage rates, and longer time spans between planned outages is more critical today than ever in our history.

The causes of plant unavailability are well defined, and sound, technology-based solutions are commercially available to improve plant availability and help restore our historic reserve margins.

Causes of plant unavailability and recommendations for solutions have been generally categorized according to the magnitude of their impact on plant availability in the following list:

Area 1: Boiler/Steam Generator

The primary cause of unavailability of our coal-fired plants is the reliability of the boiler/steam generator. Severe duty on both the fire side and the water/steam side of the various heat transfer surfaces in the boiler/steam generator cause frequent unplanned outages and lengthening of planned outages to repair

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failures to these critical components of the power plant. Replacement of these components will significantly reduce outages and increase the facility's availability and total generation output capability. Examples of our recommendations for improving the availability of the boiler/steam generator are:

- a. furnace wall panel replacements;
- b. reheater component replacements;
- c. primary superheater component replacements;
- d. secondary superheater component replacements;
- e. economizer replacements;
- f. various header replacements;
- g. furnace floor replacements;
- h. cyclone burner replacements; and
- i. incorporation of improved materials of construction for items a-h.

This area represents between 50% and 70% (depending on age, design, and operating history of the unit) of all lost generation from our coal-fired fleet. The industry data sources referenced above indicate that if improvements to the boilers/steam generators on our plants that are older than 20 years can be made to restore these facilities to the condition of plants that are under 20 years, we will benefit from an attendant improvement in reliability/availability. To help quantify this finding, plants older than 20 years are, on average, currently experiencing nearly 10% loss of achievable generation due to problems in the boiler/steam generator. This compares to approximately 5% loss for plants that are less than 20 years old. If we can recover only this differential through restoration of the boiler/steam generator, we will be taking advantage of nearly 9,000 MWs of available generation capacity in our existing coal-fired generating fleet. This figure is expected to increase significantly as our older generating units are dispatched more often to meet the growing demand for electricity considering the less than adequate new capacity coming on line.

Although the implementation of any (or all) of these recommendations will significantly increase plant availability, recent regulatory treatment of previously routine repairs, maintenance, and replacement as modifications by the EPA discourages utilities from pursuing these kinds of projects in their future plans for availability improvement for fear of triggering NSR with accompanying permitting and modeling requirements. NSR can radically undermine the economic feasibility of these projects, preventing recapture of lost generating capacity or increased reliability.

Area 2: Steam Turbine/Generator

Problems with the steam turbine/generator represent the second largest source of reduced generation capability in coal-fired plants. This area represents a 3% loss of generation compared to up to 10% for the boiler/steam generator. An interesting finding from our analysis is that the data sources referenced above show very little difference in loss of generation capability due to turbine/generator problems between plants older than 20 years and plants younger than 20 years. This phenomenon may be due to the regimented safety and preventative maintenance program typically mandated by turbine manufacturers and followed by plant owners for the steam turbine/generator.

Section 2 describes turbine/generator improvements (e.g., uprating) that can change gross plant outputs without changing the turbine/generator's relatively good track record on availability. In addition to turbine uprating, some of the general improvements that have occurred in steam turbine design will also improve the availability/reliability of existing steam turbines. Recommendations include: